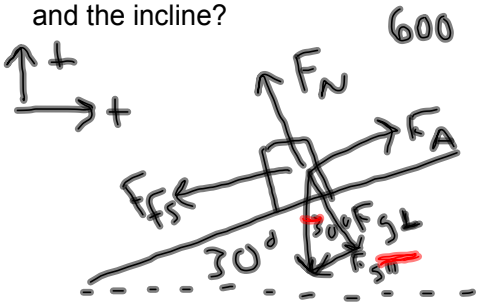
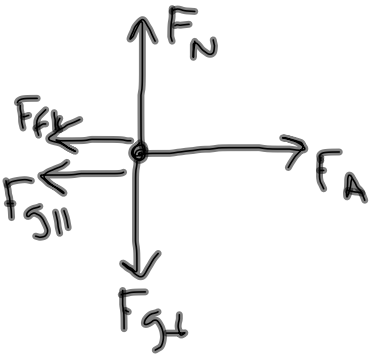
Force Practice Problems 1st Block 9.23.11

A block is at rest on a ramp that is inclined at 30 degrees above the horizontal. The mass of the block is 85 kg, and the applied force (direction is along the ramp) that just causes the block to move is ~~130~~ 600 N. What is the coefficient of friction between the block and the incline?





$F_A - (F_{fs} + F_{g\parallel})$ F_g

$F_{fs} = \mu_s F_N$

$\mu_s = \frac{F_{fs}}{F_N}$

$= \frac{183\ N}{721\ N}$

$= .254$

$\Sigma \vec{F}_{\parallel} = \emptyset$

$F_A - F_{fs} - F_{g\parallel} = \emptyset$

$F_{fs} = F_A - F_{g\parallel}$

$= 600\ N - 417\ N$

$= 183\ N$

$\Sigma \vec{F}_{\perp} = \emptyset$

$F_N - F_{g\perp} = \emptyset$

$F_N = F_{g\perp}$

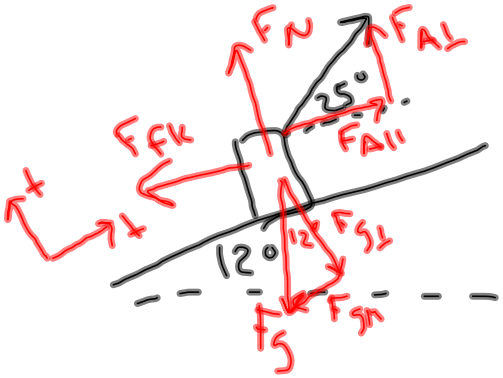
$= F_g \cos\theta$

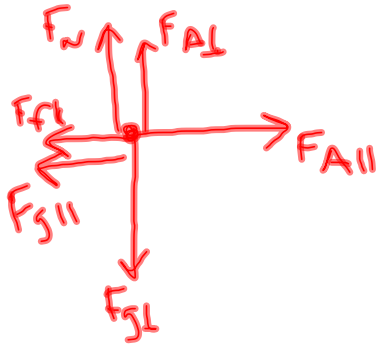
$= 721\ N$

Choose one of Newton's Laws that best explains each situation or statement.

- The reason why the ground doesn't let you fall through.
- The reason you rock to the left when you make a right turn in a car.
- Wear your seatbelt so you won't get thrown out of the vehicle!
- Pets have a hard time walking on slick kitchen floors.
- That funny sensation when an elevator going up comes to a stop.
- A cannon on wheels will roll backward when it is fired.
- The same cannon (see last problem) will accelerate more slowly than the cannon ball after fired.
- I'd rather be in a wreck with a car than a Mack truck!
- A space shuttle in space will only need a small boost to reach a planet; no more gas is needed after the boost!
- The reason the space shuttle can go upward when launching.

A student move a box (mass = 35.0 kg) up a ramp inclined 12 degrees with the horizontal. If the box starts from rest at the bottom of the ramp and is pulled at an angle of 25 degrees with respect to the incline at 185 N, what is the acceleration up the ramp? Assume that mu_k =0.27.





$$\Sigma \bar{F}_{\parallel} = M\bar{a}_{\parallel}$$

$$\Sigma \bar{F}_{\perp} = 0$$

$$F_N + F_{A\perp} - F_{g\perp} = 0$$

$$a_{\parallel} = \frac{\Sigma F_{\parallel}}{m}$$

$$F_N = F_{g\perp} - F_{A\perp}$$

$$= F_g \cos(12°) - F_A \sin(25°)$$

$$= \frac{F_{A\parallel} - F_{g\parallel} - F_{fk}}{m}$$

$$= \frac{F_A \cos(25°) - F_g \sin(12°) - \mu_k F_N}{m}$$

$$= \frac{F_A \cos(25°) - F_g \sin(12°) - \mu_k \left[F_g \cos(12°) - F_A \sin(25°)\right]}{m}$$

A 2.0 kg block on an incline at a 60 degree angle is held in equilibrium by a horizontal force.
a) Determine the magnitude of this horizontal force. (Disregard friction.)
b) Determine the magnitude of the normal force on the block.

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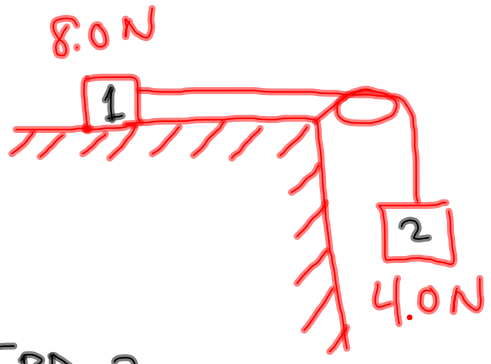
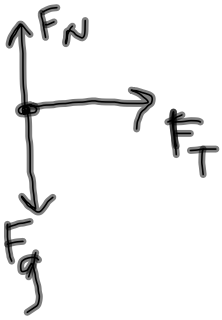
An 8.0 N block sits on a horizontal surface and is attached to a 4.0 N block that is hanging. They are attached by a string wrapped over a frictionless pulley, and begin to accelerate. Find the acceleration of the blocks as they move.



FBD 1:



FBD 2:

find net force on system → both blocks together

$$\Sigma \vec{F}_{Total} = M_{Total}\vec{a} = (m_1 + m_2)\vec{a}$$

$$F_{g_2} = (m_1 + m_2)a$$

$$a = \frac{m_2 g}{m_1 + m_2}$$

$$= \frac{4.0\,N}{1.22\,kg}$$

$$= 3.27\,m/s^2$$

Two hanging blocks (block 1 mass = 8.0 kg; block 2 mass = 5.0 kg) are attached by a rope that is hung over a frictionless pulley.
a) Which way does each block accelerate?
b) What is the magnitude of the acceleration?